US Army Corps of Engineers
North Central Division

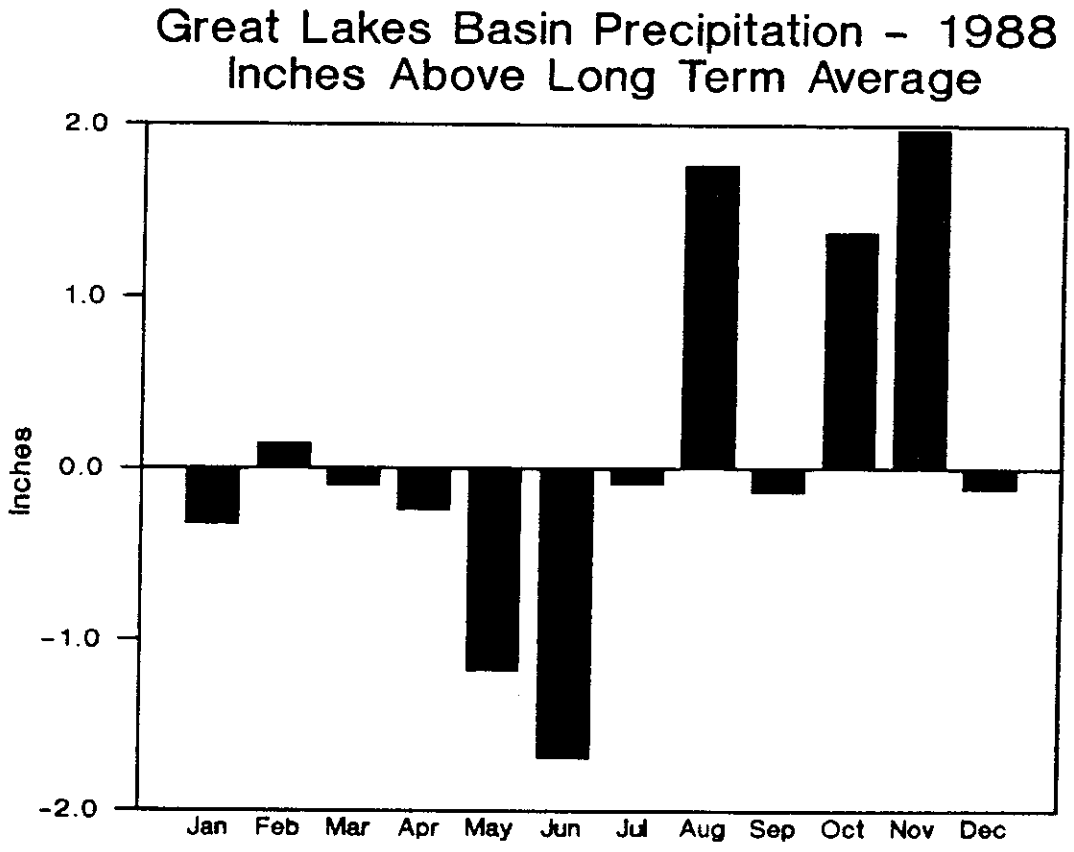
Great Lakes Levels
Update No. 42
1988 Annual Summary
January 4, 1989

In retrospect, the year of 1988 ended the history of record high water levels in 1985, 1986 and early 1987. The contrast in 1988 was drought and below-average levels. Those who live, work and recreate on the Great Lakes have in recent years experienced yet again their tendency to fluctuate.

Precipitation

The year began dry, especially on the lower lakes. The Lakes Erie and Ontario basins only received about half their average snowfall in January; basin-wide snowfall was about 85% of average. While February was slightly wetter than average, there followed five consecutive months of below average precipitation -- what I termed the "Great Drought of 1988" in one of my newsletters last summer. By the end of June, the Lake Michigan basin had a cumulative precipitation deficit of over five inches, or 35% below average for the year. The Lake Erie basin had a deficit of seven inches for the same period, resulting from precipitation 40% below average. Basin-wide, the six-month period had a deficit of about 3-1/2 inches, or 25% below average. During this time, the Lake Michigan basin set new records in both May and June for least total monthly rainfall; the Lake Erie basin set a similar record in June, receiving less than half of the previous record low amount, set in 1952. In all of these three records, the affected lake basin received less than one inch of rain for the month.

In the last half of 1988 precipitation increased. While July, September and December were all slightly below-average, August, October and November were all extremely wet, with Lake Superior setting new records in August and November. So, overall, 1988 ended with about 1-1/2 inches more than average total precipitation for the year. Figure 1 shows the inches of precipitation above or below average, by month, in 1988.



Lake Levels

At the beginning of 1988, Lakes Superior and Ontario were slightly below average. The other three lakes were well above average. Lake Superior levels remained close to their monthly averages until May, as the drought began to set in. There was essentially no fluctuation during May through July so that the lake stayed near low water datum (causing concern for the available navigation depth). July's level was about a foot below long-term average. In August the record rainfall caused the water level to rise sharply. November's record rainfall caused the lake to peak in November, about 2-1/2 months later than normal. The lake ended 1988 -- slightly above average.

Lakes Michigan-Huron began 1988 nearly a foot above long-term average. A warm spring caused these lakes to peak in May, about two months earlier than normal, and then the drought caused levels to tumble throughout the summer and early fall. In July they were below-average for the first time in the last 11 years. November's heavy rain brought levels to near average. The lakes ended 1988 slightly above average.

Lake St. Clair began 1988 about 1-1/2 feet above long-term average. It stayed close to this level into May, when it reached its peak, about two months earlier than normal. At that time, it was about 3/4 foot above average. The drought caused the lake to drop faster than its normal seasonal decline so that by October it was very near its average level. During the summer there were some inconveniences reported on Lake St. Clair with some recreational boaters becoming grounded on previously well-covered sand bars and rocks. November's rains caused the lake to halt its seasonal decline. It ended 1988 about four inches above average.

Lake Erie began 1988 nearly 1-1/2 feet above long-term average. The lake peaked in April, about two months earlier than normal. As for Lake St. Clair, the continued lack of rainfall caused Lake Erie's level to drop rapidly. July and August levels were within 1/4 foot of long-term average; September and October were essentially at long-term average. It ended the year about three inches above average.

Lake Ontario began 1988 at average level and stayed near average in January and February. It was below average the rest of 1988. Downstream at Montreal there were low levels throughout the summer, limiting commercial shipping activities. The Ottawa River, which joins the St. Lawrence River at Montreal, had record or near-record low flows most of the summer.

Storms

The 1988 storm seasons (spring and late fall-early winter) were notably uneventful. Beyond a number of small and moderate storms, only one severe storm occurred: on Lake Superior. There were no damaging storm events in 1988. The one severe storm was on March 12th and produced a once-in-ten-year storm rise at Duluth. This storm was not enough to cause damage because the stillwater lake level was 600.07 feet, about average for March. Such a storm at the height of the high water period would likely have caused severe damages.

Lake Regulation

At the beginning of 1988 there was still about one inch of water temporarily stored on Lake Superior as a result of the IJC's emergency actions in 1985 and 1986 to alleviate high levels downstream. This temporarily stored water was released during January through April at a rate of 7,500 cubic feet per second (cfs) per month.

Even with the 7,500 cfs per month additional flow releases, the outflow of Lake Superior during these four months was below average. With the lake hovering near low water datum, only the 55,000 cfs minimum allowed by regulation was released in July and August. August's heavy rains on the Lake Superior basin with the resulting rise in lake levels, called for an outflow for September of 70,000 cfs, still well below average. The outflow was decreased in October and again in November to the 55,000 cfs minimum. November's heavy rain caused Lake Superior to rise again with the regulation plan prescribing a December outflow of 81,000 cfs. December was the only month of 1988 with above-average outflow.

As noted earlier, Lake Ontario began 1988 near long-term average levels. The outflows were reduced the second full week of January to aid in developing a stable ice cover on the St. Lawrence River. The flows were dropped further the third week of January to 220,000 cfs, the minimum for 1988. Thereafter, the flow was gradually increased to the extent that the ice cover could safely handle the flow. A warm spell in the middle of February required the flow to be decreased for two weeks as ice conditions deteriorated. The breakup of the ice cover in March proceeded without problems.

The Ottawa River inflow to the St. Lawrence River at Montreal peaked in April. Lake Ontario outflows were reduced during this time by up to 15,000 cfs, and again, there were no problems encountered.

In May, the International St. Lawrence River Board of Control, using its discretionary authority, released less than the flow called for by strict adherence to Plan 1958-D, causing Lake Ontario's level to be about one inch higher than it would have been. The Board did this in an attempt to bring Lake Ontario's level closer to long-term average. At the end of 1988 some of this discretionary deviation was repaid as part of the winter operations during December.

IJC Reference Study

Work continues on the August 1988 Reference Study with several milestones accomplished. A public forum was held on 22 October in which ten cities across the basin were linked by television. I, and other members

of the Study's Project Management Team, provided information on the study and answered questions from all participating sites. Responses to the forum were positive with several participants stating that they wished for such public input to continue. If, during Phase I, we have additional forums, or other public meetings, I will let you know via these newsletters.

The IJC provided, in November, its Interim Report to Governments, as requested in the 1 August 1986 Reference. The Interim Report can be obtained by writing to the International Joint Commission, 2001 S Street NW, Washington, DC 20440. The Report contained five recommendations, briefly summarized here:

1. Governments should immediately initiate discussions of the use of Great Lakes water, as previously recommended in the IJC's 1985 Diversions and Consumptive Uses Report.
2. Governments should develop emergency management plans for both high and low levels, using the information provided in the October 1987 report by the Commission's Task Force.
3. All levels of government should discourage new construction on the shoreline pending completion of the Reference Study.
4. Governments should ensure that no further encroachment occurs in the connecting channels of the Great Lakes.
5. Governments should continue the public information and technical activities emphasized in the recent high water crisis.

We are looking in May of this year to the completion of Phase I of the Reference Study, and providing an interim report to the IJC on it.

Other Activities

On 31 May there was a public meeting held in Clayton, New York, (chaired by Congressman David Martin) to discuss the conditions of Lake Ontario and the St. Lawrence River. I provided an assessment of current and likely future conditions. A number of people were concerned that the river levels would be lower in 1988 than in 1987. With the anticipated lower outflows, the public was assured that this would most likely not be the case. This judgement was proven out as the summer progressed.

The "Advance Measures" emergency response to the flood threat of 1985-87 ended for the most part in 1988. In perspective, the 12 projects constructed at a total cost of about $13 million turned out to be a very good program. The projects have already more than paid for themselves with an estimated $36 million damages prevented. They were constructed with the understanding that the local interests would maintain them for a period of at least 15 years. When the lakes rise again (and I can't predict the timing) these projects will continue to provide protection. A final report on the overall emergency measures program is being prepared by the Detroit District.

A 1985-87 high water situation report was completed in December for the Great Lakes U.S. Shoreline. An analysis of existing data provided an assessment where the greatest damages occurred and a rough estimate of the U.S. shoreline value as well as the amount spent on protection. A rough assessment was developed based on a variety of existing information sources, with the primary sources being the Great Lakes States damage data which was developed as part of the IJC Task Force Study. The report places a value on the U.S. shoreline at about $15 billion (not including buildings or improvements). It was determined that there was about $290 million in U. S. shoreline damage in 1985-87. In addition, about $139 million was spent constructing shoreline protective works (mitigation). While a detailed assessment may modify this value somewhat (some pilot field surveys of shoreline impact assessments are anticipated), the analysis showed that 1985-87 was similar in total damages to 1972-76. The 1985-87 flooding damages were about equal to 1972-76; whereas erosion damage was greater in the 1972-76 high water period. Figures 2 and 3 show the locations on each lake of the shoreline areas subject to erosion and flooding damages. There was the potential for greater damage during 1986 (with record high levels), but there were fewer and less severe storms than the average frequency. The table below shows the estimated damages by lake for erosion, flooding and cost of protective works. It also compares damage estimates from 1985-87 to those from 1951-52 and 1972-76.

Preliminary Damage Assessment to U.S. Shoreline
Indexed to 1987 Dollars (Millions)

Lake	Erosion	Flooding	Total Damage	Mitigation
Superior	76	9	85	6
Michigan	46	20	62	64
Huron	3	16	19	19
St. Clair	0	66	66	19
Erie	20	35	55	22
Ontario	2	1	3	9
Total (1985-87)	143	147	290	139
Total (1972-76)	213	126	339	338
Total (1951-52)	284	97	381	N/A

The total Great Lakes damages from all of these events was over $1 billion and nearly $0.5 billion was spent to construct shoreline protective structures.

I will continue to issue monthly bulletin updates to accompany the Levels Bulletin in the coming year.

Theodore Vander Els

THEODORE VANDER ELS
Brigadier General, USA
Commanding

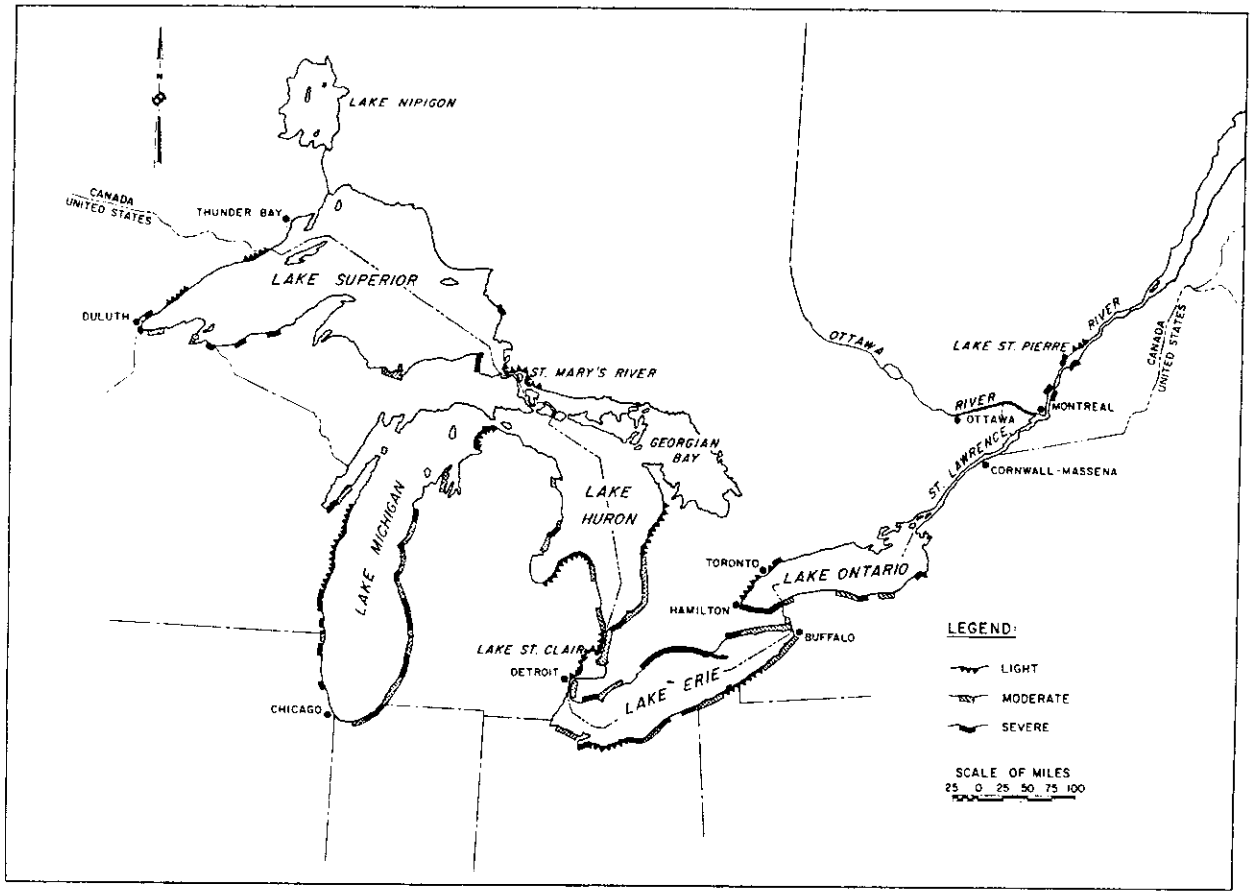


FIGURE 2 - GREAT LAKES - ST. LAWRENCE RIVER SHORELINE SUBJECT TO EROSION

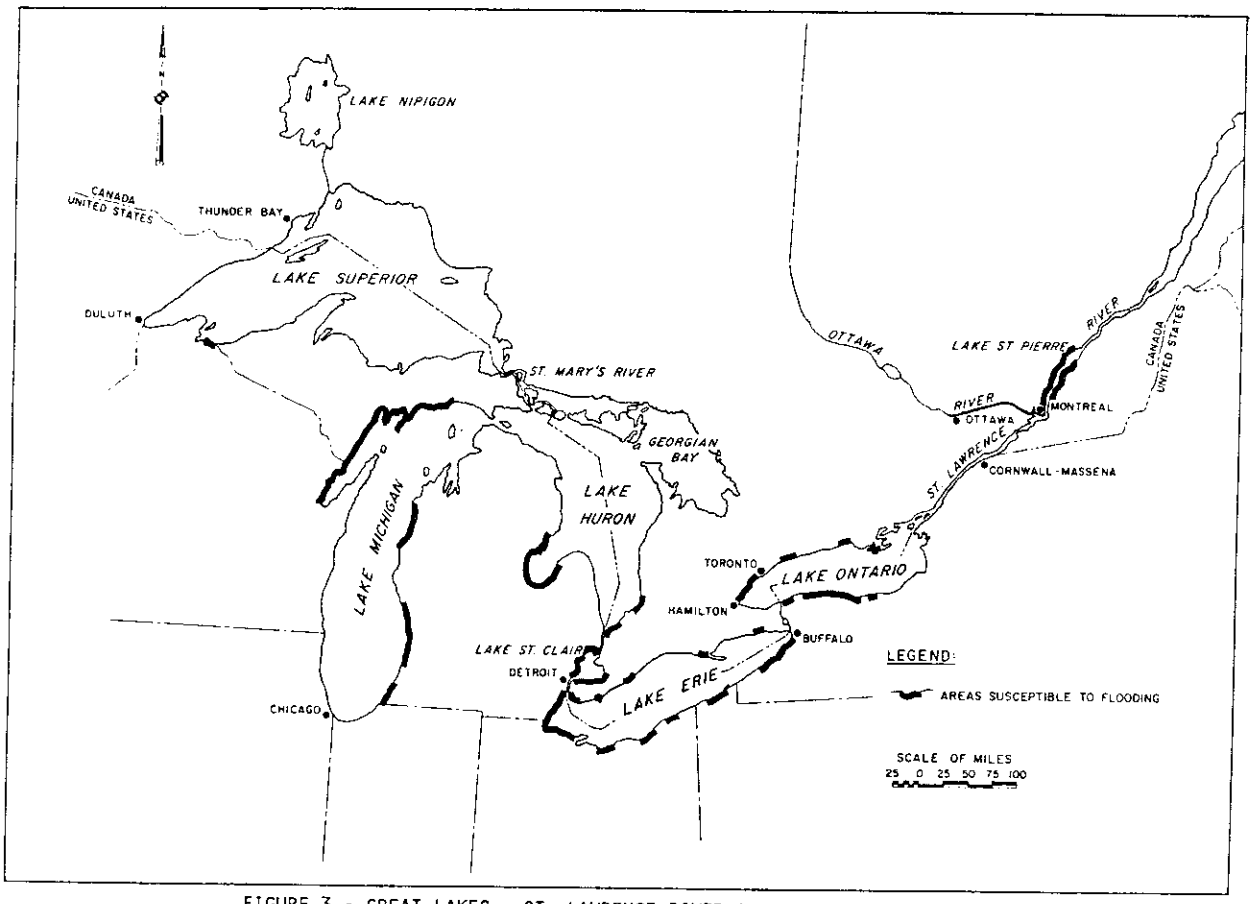


FIGURE 3 - GREAT LAKES - ST. LAWRENCE RIVER SHORELINE SUBJECT TO FLOODING

Lake levels lowered by the summer's drought and strong winds left this boat high and dry on the lower Detroit River near Grosse Ile, Michigan. (Photo credit: The Ile Camera, Grosse Ile, Michigan)

For Great Lakes basin technical assistance or information, please contact one of the following Corps of Engineers District Offices:

For New York, Penn.& Ohio:
Colonel Hugh F. Boyd III
Cdr, Buffalo District
1776 Niagara Street
Buffalo, NY 14207-3199
(716) 876-5454, Ext. 2201

For Mich.,Minn.& Wisc.:
Colonel John D. Glass
Cdr, Detroit District
P.O. Box 1027
Detroit, MI 48231-1027
(313) 226-6440 or 6441

For Ill.&Indiana:
LTC Jess J. Franco Jr.
Cdr, Chicago District
219 S. Dearborn St.
6th Floor
Chicago,IL 60604-1797
(312) 353-6400